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Correspondence

Undergraduate medical anatomy teaching

In 1989 the Management Committee of the Anatomical Society of Great Britain and Ireland decided upon a review of undergraduate Medical Anatomy teaching. The then President, Professor E. J. Clegg, requested that a Working Party be convened for the purpose of presenting a Report to the Council of the Society. The Working Party had the following membership: Professor J. W. S. Harris, Royal Free Hospital School of Medicine (incoming President); Professor D. J. Riches, Queen Mary and Westfield College, London (Assistant Secretary); Professor J. S. G. Miller, University of Newcastle; Dr Maeve FitzGerald, University College, Galway; Dr Diana Watt, St Bartholomew's Hospital School of Medicine; and Professor M. J. T. FitzGerald, University College, Galway (Convener).

The Report, which follows below, was presented to Council in July 1991. It incorporates views expressed by members from 33 medical schools and offers commentary on these views in the light of the pedagogic principles that should inform everyone engaged in curricular design. The recommendations of the Report appear to be consistent with the guidelines for undergraduate medical education contained in the Interim Document issued by the Education Committee of the General Medical Council in Summer 1991.

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INTRODUCTION

The Working Party was given the following terms of reference: (1) to produce a description of 'good practice' in the teaching of anatomy (including histology) to medical students; (2) to recommend the ideal total number of hours which should be devoted to anatomy, with special reference to dissection; (3) to examine the relationship of anatomy to undergraduate clinical training. Permission was given to consider other kindred matters should they arise.

The Working Party deliberated upon the most useful way in which anatomy may be taught, in the light of opinions among the Membership of the Society, in the light of current curricular emphases and pressures, and in the context of sound educational principles.

OPINIONS OF THE MEMBERSHIP

In June 1990 a questionnaire was circulated to the Membership soliciting opinions about optimal teaching/learning arrangements with respect to gross anatomy, histology, embryology and neuroanatomy. Seventy replies were received. Years of teaching experience ranged from 4 to 46. Respondents had come into anatomy from medicine and science in equal numbers (Fig. 1). The difference in teaching experience between the two groups reflects the increasing recruitment of science graduates into medical anatomy teaching.

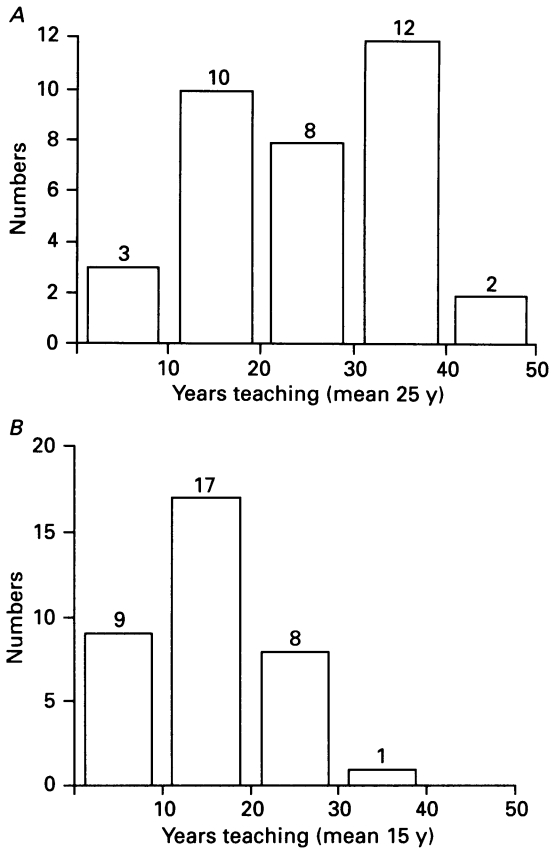

Fig 1. Teaching experience of the 70 respondents to the questionnaire. *A*, medicine base; *B*, science base.

Optional duration of the Anatomy course as a whole

Sixty-two respondents gave the range of estimates shown in Figure 2 for total teaching time in an optimal course in medical anatomy. The histogram is wide and somewhat bimodal, suggesting that 2 overlapping groups might be involved, and this proved to have been the case. As will be shown, the explanation did *not* lie in the 2 different academic backgrounds of the respondents.

Gross anatomy

Times recommended for gross anatomy as a whole are summarised in Figure 3 (62 replies). Times for dissecting room anatomy are given in Figure 4 (57 replies). The histograms will be examined in Section 3 of this Report.

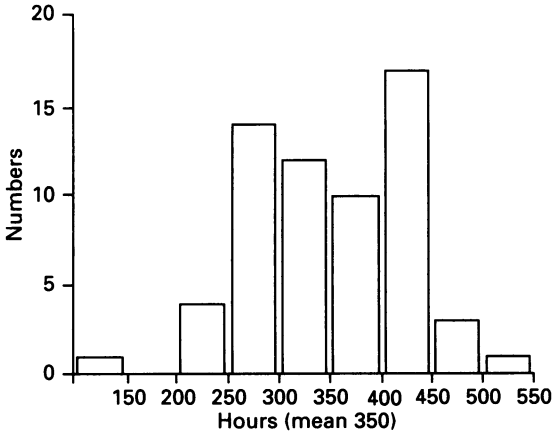

Fig 2. Total anatomy teaching time recommended by 62 respondents.

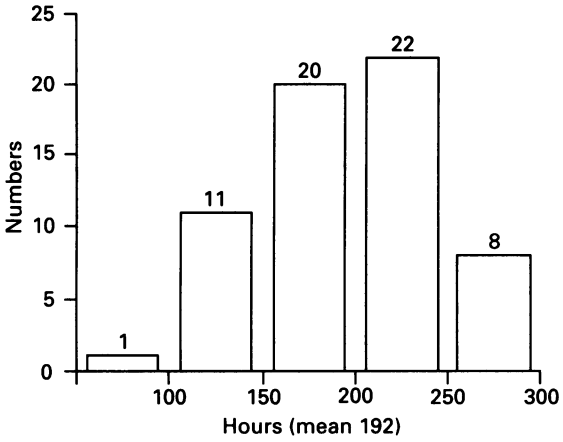

Fig 3. Total gross anatomy time recommended by 62 respondents.

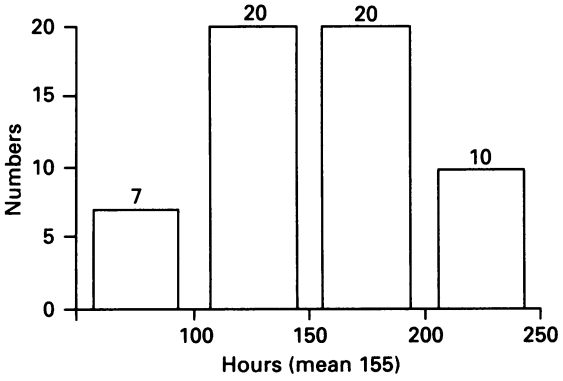

Fig 4. Dissecting room time recommended by 57 respondents.

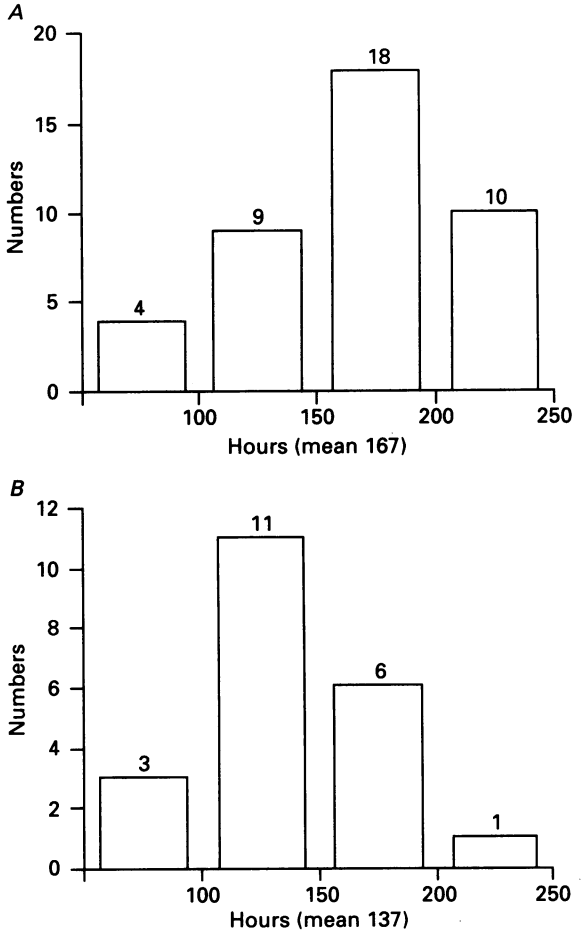

Fig 5. Dissecting room times recommended by (*A*) groups A and (*B*) group B.

'*Should students be required to dissect all parts, or required to dissect only some parts, or not required to dissect at all?*'

The 62 replies to this question could be categorised as follows: *Group A*. Dissect all parts, with the possible exception of difficult regions such as the face and perineum (41 in favour). *Group B*. Experience only a little dissection (13) or none (8). A medical qualification seemed to have no bearing on the choice made.

Analysis of dissecting room times recommended by the 2 groups gave the results shown in Figure 5. The chief reasons for choices made were as follows:

Group A. Twenty-five gave one or more reasons for advocating complete dissection: cultivation of 3D sense of anatomical relationships (12); active participation in the learning process (7); 'best method' (4); teaches manual dexterity (2); better recall of facts later on (2); less staff-intensive (1). No respondent referred to relative convenience!

Group B. Nineteen gave one or more reasons for advocating limited or no dissection: efficiency (9); allows more time for study of completed dissections (3); recall of facts is just as good later on (3); 'it works' (2); students can see and handle all important structures (2); allows more time for other disciplines (2).

The majority of group A recommended assignment of 4 to 6 students per cadaver. Group B recommended 4 to 9.

Histology

Figure 6 summarises the estimates received concerning 'sufficient' time allocation for histology. Approval of the

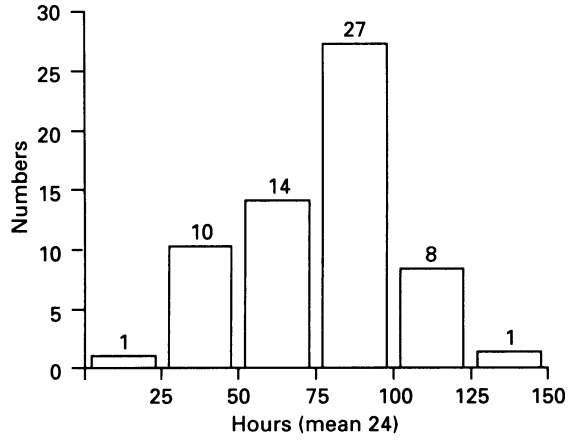

Fig 6. Histology teaching hours recommended by 61 respondents.

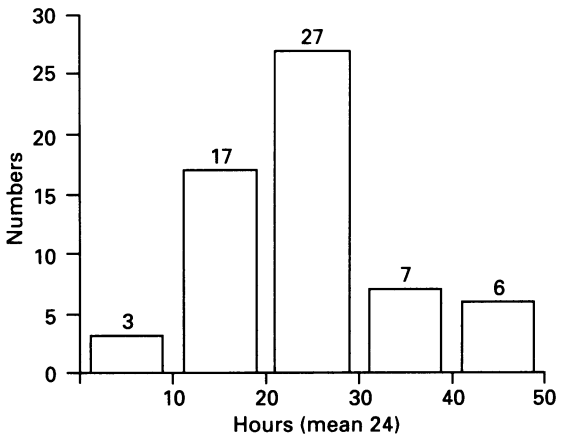

Fig 7. Embryology teaching hours recommended by 60 respondents.

use of class sets of slides for light microscopy was unanimous. Many respondents stressed the need for ample provision of electron micrographs, and some mentioned demonstration slides showing special histochemical techniques. Three dwelt upon the usefulness of sets of 35 mm transparencies for small-group use with table-top projectors and descriptive cards. The transparencies were perceived as particularly useful in highlighting salient features of slides to be examined, and in reducing the demand for demonstrators.

Comments. The benefits of personal study of tissue sections by light microscopy are understood by all who teach the subject, and there is no need to list them here. In most departments, light microscopy is the chief medium of laboratory instruction. In some, it seems to be the *only* medium.

A significant purpose of histology teaching is to prepare students for laboratory sessions in histopathology. It is of interest to note that teachers of pathology have moved in recent years, in that they regard the light microscope as just one of the resources used to provide a holistic picture of disease processes (Lakhani et al. 1990). Other resources available in the laboratory include case histories, radiographs and surgical specimens.

Very few histology teachers seem to have followed this example, even though a holistic approach is clearly desirable. It should not be difficult. Small groups of students could be issued with portfolios of photographs, brief explanatory text, and questions of a functional/clinical nature. The photographs could touch upon all relevant aspects of the organ or system: gross morphology, LM appearances, histochemistry, cell dynamics, ultrastructure. Slides and a microscope would be part of the total ensemble.

Embryology

Figure 7 summarises the optimal time estimates for embryology.

Asked whether the course should be given simultaneously with the gross anatomy course or at its conclusion, 48 thought it should be simultaneous, 2 that it should be at the end, and 2 that the bulk of the embryology course should be given ahead of the gross anatomy. (The rest gave no opinion.) As for *postnatal* growth and development, 38 regarded this as the affair of paediatricians and 14 believed the anatomists should teach or introduce it.

Most respondents emphasised the value of models and films for embryology teaching. Only 1 believed that slides of sectioned embryos need to be examined.

Neuroanatomy

Figure 8 summarises the optimal time estimates for neuroanatomy.

Perceptions of the best approaches to teaching the gross anatomy of the brain and spinal cord were as follows: dissection (45); study of prosected parts (48); brain slices displayed in conjunction with CT scans (54). Thirty-three favoured all 3 approaches. Study of prosected parts was recommended by a much larger proportion of respondents than was the case for gross anatomy in general. This may reflect the widespread difficulty in obtaining sufficient brains from autopsies. Twenty would like class sets of histological slides of brainstem, etc. to be provided; 10 would merely like slides to be on demonstration, with captions.

Summary of average recommended teaching hours

Averaged time recommendations for all components of anatomy are summarised in Table 1.

Optimal linkage of anatomy teaching to clinical teaching

All of the 58 who expressed opinions maintained that the relevance of all components of anatomy to pathology and clinical medicine should be emphasised. Participation of anatomists in the clinical programme was desired by only 28, whereas 59 wanted clinicians, including radiologists, to give illustrated talks to the preclinical students. Some respondents emphasised the need for care in the choice of personnel for this type of activity.

Five respondents stressed the value of overviews presented by anatomists to clinical students at the commencement of

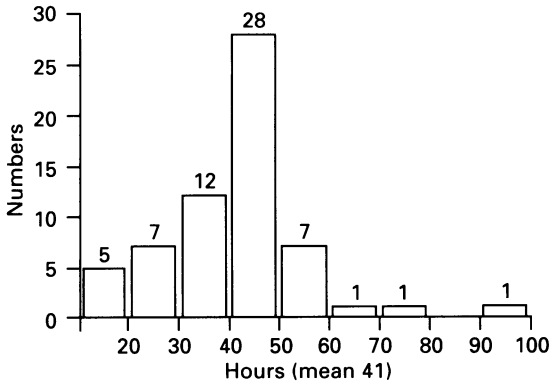

Fig 8. Neuroanatomy teaching hours recommended by 62 respondents. (Some respondents had difficulty because of fusion with neurophysiology and neuropharmacology teaching.)

Table 1. *Averages of recommended teaching hours*

	No. of respondents	Average no. hours recommended
Total anatomy	62	350*
Gross anatomy	62	92
Dissecting room	58	155
Histology	62	82
Embryology	61	24
Neuroanatomy	61	41

* In 10 cases the totals included genetics or other allied subject; hence the 11 h difference between 1 and 2, 4, 5, 6 aggregate.

special attachments in ophthalmology, obstetrics/gynaecology and otolaryngology.

Neuroanatomy was considered to offer outstanding opportunities for concurrent study of basic and applied aspects. The opportunities included talks by neurologists, case presentations by neurologists, videotapes illustrating the effects of lesions at various levels of the nervous system, and paper exercises.

Although the Systems Approach to medical education (whereby the basic and the applied aspects of each of the body systems are dealt with more or less simultaneously) offers abundant opportunities for integrated teaching, 32 respondents replied 'no' to a query about this approach, without giving reasons, although these would very likely include the administrative convenience of preserving traditional departmental boundaries. Among 32 who replied 'yes', several mentioned the time and effort required to make the Systems Approach work.

Science-based anatomy teachers

'Given the increasing recruitment of science (rather than medical) graduates to anatomy departments, how can science graduates best learn the clinical applications of the subject matter taught to medical students?'

Almost everyone (68) had something to say, whether their first degree was in medicine or science. Suggestions made by 2 or more respondents are listed in Table 2.

Table 2. *Medical training of science-based anatomists; recommendations from the Membership*

New appointees from science should:	Recommendations from Medical anatomy	Science anatomy
Be introduced to the relevant clinicians who should invite them to attend ward rounds and outpatients departments	13	21
Receive tuition from medically qualified anatomists and from FRCS (part A) candidates	11	11
Read introductory clinical textbooks	4	4
Get involved in an integrated curriculum	2	—
Not be unduly concerned: what is of prime importance is that they should be effective teachers of basic anatomy	6	2

'Could the Anatomical Society/British Association of Clinical Anatomists contribute by organising teacher training sessions?'

Twenty-one positive responses were received (12 science, 9 medical). Several of these included reservations about funding for travel and accommodation.

Comments. A dichotomy of purpose is sometimes evident in choosing among candidates for University posts in anatomy. On the one hand, there is a manifest need to appoint people who are familiar with human topographical anatomy and its numerous points of clinical relevance. To meet this need, candidates with a medical degree and some postgraduate clinical experience would be most suitable. On the other hand, the basic science disciplines depend increasingly upon funding from external grant agencies. Appointment of candidates with Ph.D degrees is essential to advancement of the research effort, and prior acquaintance with human topographical anatomy may have little or no relevance.

A solution adopted by some schools has been to appoint at least one experienced medical person whose *only* academic function is to organise and participate in teaching. Far from being irrelevant to research, medical teachers facilitate the research potential of their colleagues in the department.

Applicants with a medical background are scarce. The Anatomical Society should therefore consider other possible approaches. One proposal worthy of consideration is to offer a 2-month summer course in topographical anatomy at a specified venue. Such a course could be organised by the Anatomical Society in conjunction with the British Association of Clinical Anatomists, following enquiries made to heads of departments.

One lecturer (science-based) took the view that to offer a course of instruction in clinical anatomy would be an affront to the intelligence: that sufficient mastery can be attained on one's own initiative, by linking up with relevant consultants, by informal discussions within the department, and by reading.

A second proposal would be to try to attract surgeons by offering part-time appointments in anatomy. This would be feasible for consultants having A + B appointments. Again, it may be possible to arrange for SHO surgical rotations to include anatomy demonstratorships. In this context, it would be forward-looking to try to arrange periods of attendance in anatomy as part of the new regulations being put forward by the Colleges of Surgeons.

PEDAGOGIC PRINCIPLES; WHAT WE SHOULD BE TRYING TO ACHIEVE

The Working Party would not presume to instruct the Membership about basic pedagogic principles. However, it is pertinent to *remind* the Membership of certain principles which should be manifest in the way the anatomy course for medical students is run. Several respondents to the questionnaire pointed out that the structure and scope of an anatomy teaching programme are not to be decided by the anatomy teachers in isolation: they depend (or should depend) upon the teaching philosophy of the particular medical school as a whole. Practical expression of this philosophy is subject to constraints imposed by mundane matters such as staff–student ratios, the 'tone' of relations between preclinical and clinical teachers, and the distance between campus and teaching hospital. Nevertheless, and even if traditional administrative boundaries are still in place, 'good practice' in medical anatomy teaching can be identified because it is directed towards appropriate goals.

Appropriate goals of medical anatomy teaching

Medical anatomy teaching has 2 principal goals. One of them is informational. The other is educational.

1. *The informational goal.* The informational goal is to ensure that the student has sufficient mastery of anatomy to benefit from instruction in cognate basic and clinical sciences. The principal links to the cognate basic sciences are gross and microscopic anatomy and neuroanatomy (for physiology), embryology (for genetics), and cell ultrastructure (for biochemistry).

Importance of living Anatomy. It should be self-evident that the foremost link to the clinical sciences is *living anatomy*, which must be mastered by examination of *live* subjects, both directly by inspection and palpation, and indirectly by imaging techniques of all kinds. In this context, the responses to 2 items in the questionnaire are a source of concern.

'*What principles, objectives or guidelines underlie your perception of an ideal course in gross anatomy?*'

The question was considered too vague or general by some, but of the 40 who responded, only 8 used the words 'living anatomy' or 'surface anatomy' anywhere in their replies.

'*What (if any) videotapes would you like to have that are not at present available to you?*'

Only 5 (of 38 responding) mentioned a need for living (surface) anatomy on tape or disc. Such videos are not generally available, in contrast to the large numbers on postmortem gross anatomy. Even where students are routinely involved in small-group living-anatomy sessions in or near the dissecting room, there is a place for high-quality videos – notably to show material not easily accessible to preclinical students, such as the distinctive anatomy of infants and of the elderly.

Unfortunately, videos of professional quality on living anatomy are unlikely to materialise until the need is strongly perceived by the Membership.

Importance of regional anatomy. Where Systems Teaching is a cardinal feature of the preclinical curriculum, it must not be allowed to obscure the significance of *regional anatomy*, which is fundamental to the physical and radiological examination of patients.

2. *The educational goal.* 'Students who learn independently develop abilities to seek out information and to analyse and apply it to the solution of problems. These students become original, critical thinkers who are constructively skeptical' (GPEP Report, 1984).

There is nothing to equal an intercalated B.Sc. year in one of the basic or clinical sciences, for providing an opportunity to investigate a topic in depth in an atmosphere of intellectual rigour; but most students have to forgo this privilege.

The ideal medium for independent, student-directed learning is that of *problem-solving*. Some medical schools (not in these islands) set such a high premium on this aspect that the entire undergraduate programme is centred on problems in a patient-oriented setting. Faculty members are available to provide background information and materials required for the solution of the problems (Schmidt, 1983; Newble and Clarke, 1986).

In the more usual curricular formats, whether vertically integrated or not, abundant opportunities arise for student-directed learning. Some schools offer short projects to student groups for this specific purpose, but problems can easily be set on a day-to-day basis, for example by tagging functional or clinical questions to prosections or radiographs. Computer-aided learning can also provide appropriate challenges (Clayden, 1988; Walsh & Bohn, 1990). Self-discipline is required of both parties, because it is simpler for all concerned if students are merely *told* rather than *asked*. 'Habits of autonomous, self-directed, problem-oriented learning have to be the inescapable justification for all aspects of the (medical) curriculum' (Walton, 1989).

The matter of integration

'The successful retrieval of information at some point in the future is promoted when the retrieval cues are encoded together with the information' (Tulving & Thompson, 1973). 'The closer the resemblance between the situation in which something is learned and the situation in which it is applied, the better the performance' (Schmidt, 1983). When basic science information is provided out of the clinical context in which it is to be used, students fail to establish the necessary link between the two (Patch et al. 1988).

Vertical integration (systems teaching), whereby the pathological and clinical implications of each element of the anatomy course in turn are made manifest within days or weeks, has unassailable virtues. In contrast, the traditional, stratified arrangement of courses appears indefensible.

In reality, the difference between the two approaches may not be so clear-cut. With vertical integration, basic science teachers may abandon the clinical aspects more or less completely in the knowledge of their imminence. With a stratified arrangement, most basic science teachers do make a particular effort to illustrate relevance as they go along. For example, three-quarters of respondents to the questionnaire advocated inputs from clinicians into the anatomy course. As well, almost half of the respondents advocated presentation of anatomical reviews at appropriate points during later clinical training.

The amount of student dissection required for an optimal course

Two-thirds of respondents to the questionnaire (group A) advocated more or less complete dissection of the body. One-third (group B) advocated little or none.

There are several possible reasons for the majority option of complete (or nearly complete) dissection. One is the belief that it is more effective: the student should gain a better understanding. A second is that it is relatively simple to operate by following a dissection manual. A third could be an incomplete understanding of the requirements for putting a course based on prosections into operation, and a fourth could be the labour-intensive nature of this latter type of course.

The minority option of little or no dissection has the merit of *efficiency*. The replies shown in Figure 5 reveal a mean time difference of 36 h between the 2 groups. Indeed, there is reason to believe that group B respondents are notably concerned about overall basic science educational needs: the *total time* for anatomy requested by this group averages 63 h less than group A (Fig. 9). This remarkable time saving can be explored by subtracting dissecting room time from total gross anatomy time for the 2 groups. We find that the time devoted to gross anatomy *outside* the dissecting room is also reduced in group B by an average of 22 h (Table 3). Subtraction of total gross anatomy time from overall anatomy time yields a further 5 h (Table 3).

In the light of present-day curricular pressures, it would seem incumbent upon those who advocate extensive dissection to justify their stance by means of objective criteria. The available objective evidence indicates that students who study gross anatomy from prosections alone learn more, and learn faster (Nnodim, 1990). The prevalent intuition that dissection – patient diligent unveiling – is the best mode that learning is open to challenge. For instance, the ideal number in a dissection group, according to 23 of 37 group A respondents, is 5 or 6. If 1 or 2 members are dissecting a part, what are the others doing? And since the supposed objective of dissection is to display the regions to be studied, how much time is left to study these regions after exposure has been completed, and what educational questions have been preset for the students? Some teachers point out that students who are not dissecting need not be idle: model prosections may be to hand for comparison, with questions attached; appropriate models or museum specimens may be available; and well-annotated radiographs may be on display, again with questions.

In a congested timetable, it is incumbent on anatomy staff

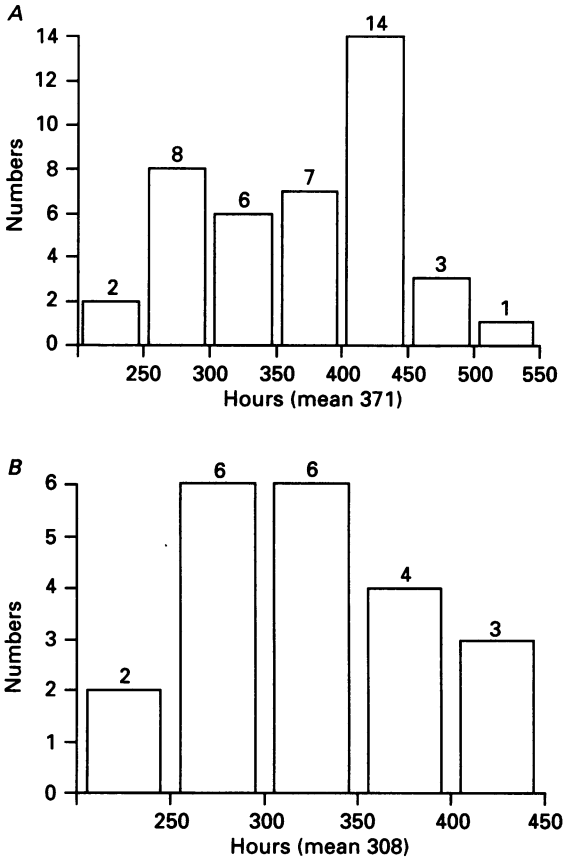

Fig 9. Total anatomy hours recommended by (*A*) group A and (*B*) group B.

Table 3. *Average teaching hours recommended by group A (dissect most or all) and group B (dissect little or none)*

	Responses		Hours		A minus B
	A	B	A	B	
1. Total anatomy	41	21	371	309	63
2. Gross anatomy	41	21	207	149	58
3. Dissecting room	38	19	167	131	36
Gross minus Dissecting			40	18	22
Total minus Gross			164	159	5

to appreciate the importance of *efficiency* in course organisation. It follows that substantial replacement of dissection by prosection must be recommended where this has not already taken place. Regrettably, no formal account of teaching by prosection seems to have been published. There is one textbook (MacKinnon and Morris, 1990) that combines the use of prosected parts, the living subject, and imaging procedures (the format may not suit some departments), but the background design and logistics are not described.

To remedy this deficiency, the Management Committee

may wish to arrange that 3 or 4 people, directly involved in administering courses based on prosected material, collude to produce a document on the subject.

CONCLUSIONS AND RECOMMENDATIONS

In response to the 3 directives received from the Management Committee, the following statements arise from the foregoing. (1) 'Good practice' in medical anatomy teaching embodies these features: (*a*) sufficient informational content for preclinical and basic clinical needs: (*b*) emphasis throughout on living anatomy and on regional anatomy, regardless of the curricular format; (*c*) closest possible integration with the relevant basic and applied disciplines; (*d*) self-directed learning at the expense of formal tuition. (2) The ideal total time which should be devoted to anatomy is approximately 300 h. Dissection should be curtailed as far as is required to meet this goal. (3) The optimal relationship of anatomy to undergraduate clinical teaching is one of intimacy. Intimacy is realised through integrated courses, by their nature. It can be realised in stratified courses through relevant allusions as the course proceeds, and by provision of a 2-way pedagogic interchange between anatomy and the clinical disciplines.

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